

CLAIMS

1. A substrate for biomolecule microarray having one or more spots for immobilizing a biomolecule, characterized in that
said spot for immobilizing a biomolecule protrudes from the surface of the substrate and has a flat surface for spotting on the top thereof, which spot is hereinafter referred to as “protruding spot part”; and
at least the surface of the substrate around the protruding spot part, the lateral surface of the protruding spot part and the flat surface for spotting are comprised of an electrically conductive substance.
2. The substrate according to claim 1, wherein said surface of the substrate around the protruding spot part forms a roughly V-shaped bottom surface.
3. A substrate for biomolecule microarray having one or more spots for immobilizing a biomolecule, characterized in that
said spot for immobilizing a biomolecule protrudes from the surface of the substrate and has a flat surface for spotting on the top thereof, which spot is hereinafter referred to as “protruding spot part”;
the protruding spot parts adjacent each other border through the lateral surface of the protruding spot part; and
at least said lateral surface of the protruding spot part and the flat surface for spotting are comprised of an electrically conductive substance.
4. The substrate according to any of claims 1 to 3, wherein said electrically conductive substance is gold, nickel, platinum, silver, titanium, aluminum, stainless steel, copper, electrically conductive oxide, or electrically conductive plastic.
5. The substrate according to any of claims 1 to 4, wherein the entire substrate is comprised of an electrically conductive substance, or the substrate has a coated layer of an electrically conductive substance on the surface thereof.
6. The substrate according to claim 5, wherein the substrate having a coated layer of an electrically conductive substance is comprised of glass, metal, silicon or plastic.
7. The substrate according to any of claims 1 to 6, wherein said protruding spot part

has a height ranging from 10 to 500 μ m.

8. The substrate according to any of claims 1 to 7, wherein the angle formed between the flat surface for spotting on the top of said protruding spot part and the lateral surface of said protruding spot part is equal to or greater than 90°.

9. The substrate according to any of claims 1 to 8, wherein said flat surface for spotting is a roughened surface.

10. A biomolecule microarray characterized by comprising the substrate according to any of claims 1 to 9 and a biomolecule; and in that the biomolecule is immobilized on at least the flat surface for spotting on said substrate.

11. The biomolecule microarray according to claim 10, wherein said biomolecule is at least one selected from the group consisting of DNA, RNA, PNA, protein, polypeptide, sugar compound, lipid, natural small molecule, and synthetic small molecule.

12. A device of promoting interaction between biomolecules comprising:
a biomolecule microarray having one or more biomolecule-immobilized spots on a substrate;

an electrode provided so as to face the surface having the biomolecule-immobilized spots of said microarray; and

a power source for applying an electric field between said microarray and said electrode;

characterized in that

the substrate included in said biomolecule microarray has spots for immobilizing biomolecules protruding from the surface of the substrate and having a flat surface for spotting on the top thereof, which spots are hereinafter referred to as “protruding spot parts”;

at least said protruding spot part has a surface of an electrically conductive substance;

the biomolecule-immobilized spots are formed by immobilizing biomolecules on the surface of an electrically conductive substance of the flat surface for spotting; and

said substrate has a terminal capable of passing an electric current to said surface of an electrically conductive substance of said protruding spot parts on the surface of said substrate in areas other than the protruding spot parts.

13. The device according to claim 12, wherein the surface of said substrate in areas other than the protruding spot parts has a coated layer of an electrically conductive substance, said terminal is comprised in said coated layer of an electrically conductive substance or capable of passing an electric current to said coated layer of an electrically conductive substance, and the coated layer of an electrically conductive substance and the surface of an electrically conductive substance of the protruding spot part are provided as an integrated coated layer of an electrically conductive substance.

14. The device according to claim 12 or 13, wherein said biomolecule microarray is the biomolecule microarray according to claim 10 or 11.

15. The device according to any of claims 12 to 14, wherein the distance between said flat surface for spotting and the electrode ranges from 1 to 500 μ m.

16. The device according to any of claims 12 to 15, which comprises a nonelectrically conductive spacer between said microarray and the electrode.

17. The device according to any of claims 12 to 16, wherein said electrode provided so as to face the surface having the biomolecule spots of the microarray is a transparent electrode.

18. The device according to any of claims 12 to 17, which further comprises a temperature control means.

19. A method of promoting interaction between biomolecules using the device according to any of claims 12 to 18, characterized by;

placing a solution comprising a target biomolecule between said microarray and said electrode, and

applying an electric field between said microarray and said electrode.

20. The method according to claim 19, wherein said electric field applied between said microarray and said electrode ranges from 0.001 to 10 MV/m.

21. The method according to claim 19 or 20, wherein said target biomolecule is labeled with a fluorochrome.

22. The method according to any of claims 19 to 21, wherein said solution comprising a target biomolecule comprises at least one buffer substance selected from the group consisting of phenylalanine, histidine, carnosine and arginine.

23. A method of detecting interaction between biomolecules, characterized in that a confocal detector is used to detect the interaction between a target biomolecule and a biomolecule on each biomolecule-immobilized spot of the microarray according to claim 10 or 11, that either lies in an environment permitting interaction with the target biomolecule, or has previously lain in an environment permitting interaction with the target biomolecule.

24. The method according to claim 23, wherein said microarray either lies in an environment permitting interaction with the target biomolecule, or has previously lain in an environment permitting interaction with the target biomolecule using the method according to any of claims 19 to 22.

25. The method according to claim 23 or 24, wherein said biomolecule on the biomolecule-immobilized spot and/or said target biomolecule are labeled with a fluorochrome.

26. The method according to any of claims 23 to 25, wherein, with said confocal detector, said protruding spot parts on the microarray are detected as a reflected image from the difference in intensity of reflected light based on differences in the height and/or shape of the protruding spot parts and other portions on the surface of the microarray.

27. The method of detecting according to claim 26, wherein the interaction between biomolecules is detected by detecting fluorescence from said protruding spot parts detected as a reflected image.

28. A method of making interaction between an immobilized biomolecule and a target biomolecule by contacting a biomolecule microarray having one or more spots immobilized said biomolecule on a substrate surface with a solution comprising said target biomolecule, wherein

said interaction is promoted by adding phenylalanine to said solution comprising a target biomolecule and applying an electric field to said solution so that the target biomolecule comprised in the solution migrates toward said biomolecule-immobilized spot.

29. The method according to claim 28, wherein said microarray is one having an electrode, on the surface of which the biomolecule-immobilized spot is provided, on a substrate; an electrode facing said electrode on the substrate is employed; and said electric field is applied between said electrodes in a state where said solution comprising said target biomolecule contacts with said two electrodes.

30. A method of making interaction between an immobilized biomolecule and a target biomolecule by contacting a microarray having one or more spots immobilized said biomolecule on a substrate surface with a solution comprising said target biomolecule, wherein

said solution comprising a target biomolecule comprises at least one buffer substance selected from the group consisting of phenylalanine, histidine, carnosine and arginine,

said substrate is one provided with at least a pair of electrodes on the same surface as the surface on which biomolecule-immobilized spots are provided so that the biomolecule-immobilized spots place between said pair of electrodes; and

said interaction is promoted by applying an electric field between said electrodes in a state where said solution comprising a target biomolecule contacts with said pair of electrodes.